School Shop

vol. II no. 6
February, 1943

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by Lawrence W. Prakken

A Small Gas Furnace
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Converting the American Housewife
by George C. Sherwood

A Test with Teaching Value
by M. F. Foss

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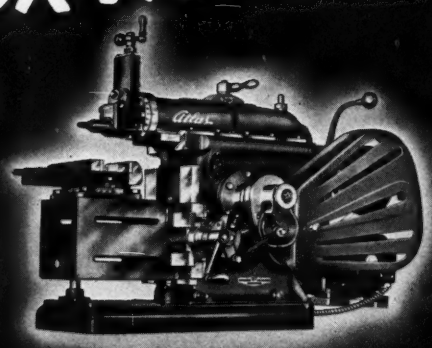

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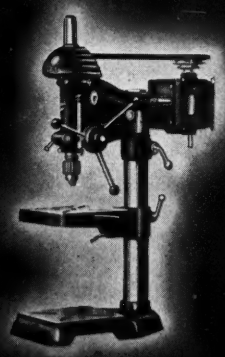

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3. ***"Course for Commando Training."***
4. ***Shop-Tested Projects.***
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School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

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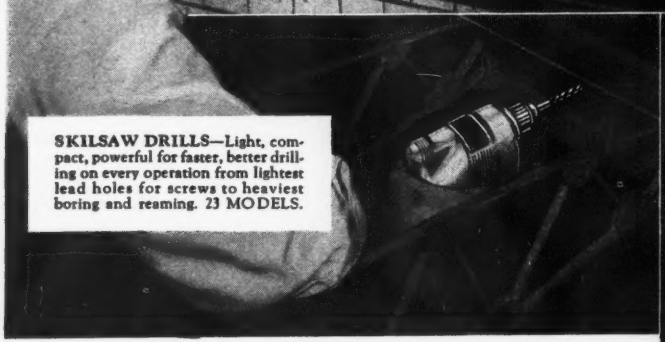

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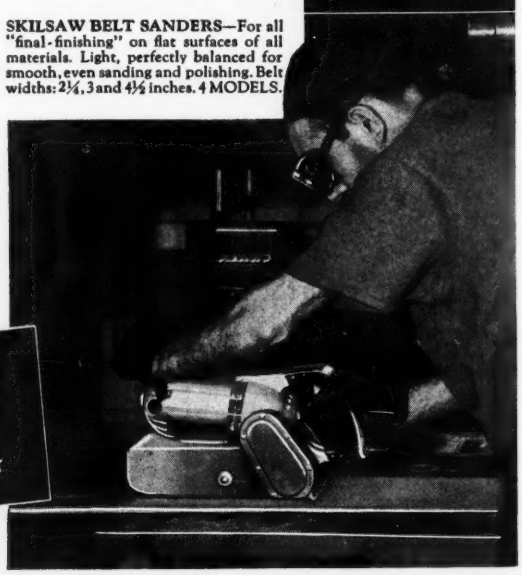

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Pre-Induction Training at Highland Park High School

BY *Lawrence W. Prakken*, EDITOR, SCHOOL SHOP

School shops everywhere will be instituting pre-induction training courses during the second semester. This article describes the experiences of a school system in a town of 50,000 in adapting its program to this important aspect of the war effort.

EARLY last fall the Army sent out an SOS to the high schools of the Nation asking for help in the training of future members of the armed forces. Lieutenant General Somervell told how the Army of today is an Army of specialists. Subsequent action in North Africa demonstrated clearly the necessity for Army men who knew radio, automotive mechanics, gasoline engines, communications, and a host of other specialties.

If the North African action is to be repeated in Norway, in Italy, in the Philippines, in Japan, in Germany itself, hundreds of thousands more men will be needed who have the essential skills for successfully completing such operations. Juniors and seniors in high schools will make up the armed forces of a year or two hence. The Army wants them to come to the induction center with a certificate from their high school stating that they have completed one year of pre-induction courses for present seniors and two years of pre-induction courses for present juniors.

The Army built up a series of pre-induction courses based on various Army training manuals. These course outlines were first made available to schools early last fall after the first semester was well under way. Some school systems instituted training programs at that time. Others planned to wait until the second semester when textbooks were available and reassignment of students to classes could be made with less confusion. This is the story of a school system that answered the call immediately.

Teachers and administrators from the Highland Park, Michigan, High School attended a meeting held in Detroit late in September at which government officials described the Army need and the program that had been set up. The following Saturday a general teachers' meeting was called by Principal William Prakken and the pre-induction program was presented to the teachers of the high school. School had been in session two weeks but the teachers decided that Army needs were more important than their established class schedules. Every junior and senior boy consulted a counselor the following days and his schedule was shifted so that, first, he was enrolled in one of the six pre-induction courses which had been organized two days before.

Fortunately Highland Park has an industrial education department under Carl Dorsey that is well equipped and staffed and could be easily adapted to pre-induction training. Some modifications were made in the pre-induction course of study to fit in more closely with the physical set-up and teaching personnel available in the school.

Radio student working on his final examination —a one-tube set.

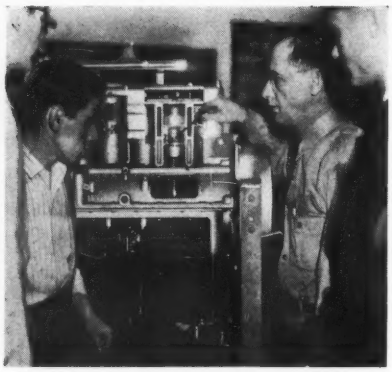
During the first semester, the following courses were offered: Fundamentals of Shopwork, Fundamentals of Radio, Fundamentals of Automotive Mechanics, Radio Code Practice, Fundamentals of Electricity, and Fundamentals of Machines. All of these courses will be offered the second semester. Following is a brief description of each of the seven pre-induction courses offered and how Highland Park went about setting each one up.

Fundamentals of Shopwork

Highland Park is set up on the unit-shop basis. There is a well equipped machine shop and an up-to-date woodworking shop. After careful inspection of the War Department's bulletin PIT-103 on Fundamentals of Shopwork, it was decided to offer two one-semester shopwork courses. The first, offered during the first semester, consists of machine-shop practice and is taught by David Conway. Several sections were scheduled, each of which met for one

Pre-induction shopwork students studying a pattern-making layout.

Instructor Chappell (right) using the Radio Club's transmitter to illustrate a point to radio students.



Students in Fundamentals of Automechanics being shown the wrist pin in a cutaway model of an automobile engine.

full hour per day, five days per week.

The course covers the metalworking topics included in the War Department's course outline plus a number of topics concerning machine-tool operation not included in the outline. Instruction is given in related subjects including shop mathematics, blueprint reading, and the use of precision tools. This course will be given the second semester also.

In addition, a Fundamentals of Shopwork course in woodworking is also scheduled. This is in reality a course in wood pattern-making taught by Lyle MacKellar but covers the skills asked for by the Army.

Thus boys can take a full year of Fundamentals of Shopwork with metalworking covered during one semester and woodworking covered during the next. Experienced teachers with trade experience teach both of these courses.

Fundamentals of Automotive Mechanics

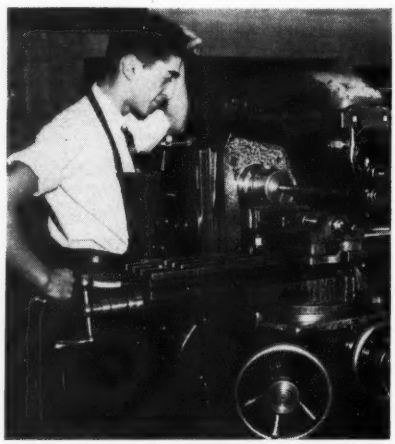
Three sections of this course are given daily in the automotive shop. Unlike the usual course in automotive mechanics, this is not a shop course, but consists exclusively of discussion of theory. The PIT Bulletin 202 is followed closely although the instructor, Vincent Hofman, has been able to boil the course down to a single semester. Army technical manuals are used as basic textbooks and constant utilization is made of visual aids. Cut-away sections of engines are used as well as wall charts, motion picture films, and Jam-Handy slidefilm kits. Each student keeps a notebook.

A night class is also taught, using the same course outline, for the benefit of 15 teachers, many of them women, under the American Red Cross Motor Corps program. Some of these teachers will be available for teaching the pre-induction course should the need arise.

Fundamentals of Radio

No courses in radio had been offered at Highland Park before. An arts and crafts instructor, Russell Chappell, is a licensed radio operator and a "Ham" of long experience. He is now devoting all of his time to the teaching of Fundamentals of Radio and Radio Code Practice. Students in radio had all completed the regular physics course so they had a good background in electricity. They desired actual work with radio parts so Mr. Chappell sent out a call throughout the school for old radio sets that could be dismantled and the parts used for instructional purposes. Over 25 sets came in and produced an adequate supply of parts. The dismantling of these sets was an educational experience in itself for the students.

The course is divided into three parts: (1) review of fundamentals of electrical theory with radio demonstrations by the instructor; (2) dismantling of sets; and



Student in Fundamentals of Shopwork course operating a milling machine.

(3) the making by each student of a one-tube or crystal set. Test equipment is borrowed from the physics department and transmission theory is illustrated through use of the school Radio Club's amateur transmitter. Instruction is vitalized through the handling of parts by the students, the use of films and other visual aids, and, of course, the construction of sets. The *Radio Amateur's Handbook* is used for construction purposes but was found to be short on fundamental theory. A new textbook will be used as soon as the pre-induction series to be issued by various publishers becomes available.

Radio Code Practice

This course is given by Mr. Chappell one hour a day, five days a week. War Department Manual TM-1454 is used. A standard key sender is used and most students had progressed to eight words a minute at the end of eight weeks of instruction. There are 40 students in the class, some of them girls.

Fundamentals of Machines and Fundamentals of Electricity

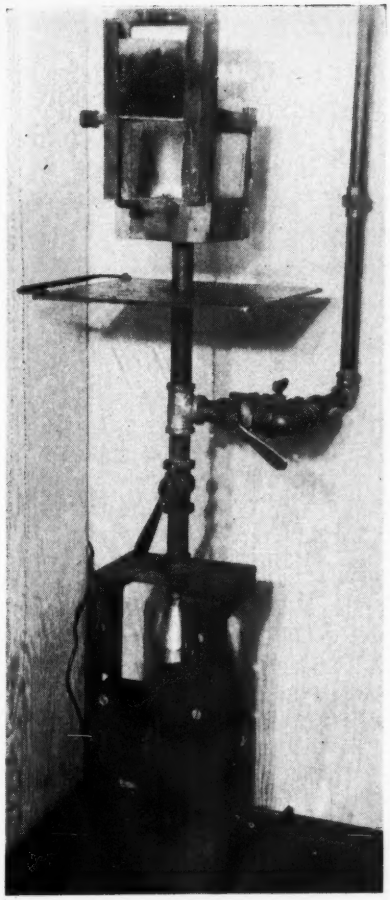
These courses are given by the science department of the school and therefore will not be discussed here.

In scheduling the pre-induction courses for various students, the counselling services of the school were utilized to the full. The senior and junior counsellors, Lou Babcock and Luke Shannon, carefully consulted with each student before classifying him in a pre-induction course. For instance, students were not allowed to take the Fundamentals of Radio Course unless they had had physics, which gave them a good background in electricity with the result that instructional time did not have to be wasted on review for students without the necessary background. The fact that the students had had physics also meant that they were academically of high standard and could profitably undertake the technical instruction given. Students with less background in science were classified in Fundamentals of Automotive Mechanics where such prerequisite training was not so essential. With Highland Park in the center of the automotive industry, many students have graduated from the "jalopy" school of automechanics in their own backyards anyway.

It will be noted that these courses frequently do not adhere strictly to the course outlines prepared by the War Department. Such deviations are not serious, according to government officials, as the course outlines are being distributed merely as suggestive plans.

In conclusion, Highland Park has adapted itself quickly to the task given it by the Army. Students who complete the courses listed above will go to their induction centers with a certificate indicating real foundation training in the skills so essential in a modern war.

Radio students dismantling old radio sets for parts to use in making their own one-tube sets.



Project of the Month:

A Small Gas Furnace

BY *P. Russell Hiller*

This small gas furnace generates an unusual amount of heat and is ideal for the small shop. It is particularly useful in teaching hardening and tempering. P. Russell Hiller teaches in the Williamsport Technical Institute, Williamsport, Pennsylvania.

A SMALL furnace is an indispensable piece of equipment in the general shop or small vocational industrial class and in the more fortunate large and well equipped shops that may boast of a large automatically controlled furnace it will prove a valuable addition, being especially useful for the many small hardening jobs, such as chisels, punches, screw drivers, etc., that can better be done by hand. It is ideal for imparting the skill of hand and eye involved in the rapidly dying art of hand hardening and tempering.

The furnace operates on ordinary household gas, either natural or manufactured, and can be constructed very cheaply, as most of the materials are already available in the average shop. It is compact, quick heating, easily controlled, and will attain a heat of over 3,000 degrees. In fact, the writer has melted No. 4140 Molybdenum steel as an experiment.

As a project, from the instructional viewpoint there are a variety of skills required and to be developed: cutting pipe threads, either on the lathe or by hand with a die, shaping, milling, turning, bending sheet metal, bending rods, lay-out, drilling, angular drilling, drilling intersecting holes, tapping, and even cutting fire brick, which is no simple task.

The largest and most important single part is the base.

Following is the suggested procedure for machining this part:

1. Lay out outside form of bed and shape or mill to the outside dimensions shown in Fig. 1.

2. Lay out and mill the recess which provides space for the fire-clay bed and the gas orifices.

3. Lay out all pipe tap holes, ¼" tap holes, and work-rest hole.

4. Drill and tap the intersecting ½" pipe plug holes which form the fuel passages in the base. Drill one hole of each pair 23/32", tap deep enough for the pipe plug to pull in tight when the top of the plug is flush with the surface of the base, first applying red lead.

5. Cut off square heads of pipe plugs and drill and tap mating hole of each pair.

6. Lay off the orifice holes on the sides of the recess equally spaced as shown in Fig. 1.

7. Set up the base on an angle of 30° and spot with a center drill to eliminate the natural tendence of the ⅛" drill to walk away on the angular surface.

8. Drill and tap the 1" feed pipe hole which also serves as the stand. This hole should not be tapped to the standard depth and care should be taken to see that the 1" pipe does not enter the hole far enough to restrict the flow of gas through the horizontal passages.

9. Drill 25/64" for work rest.

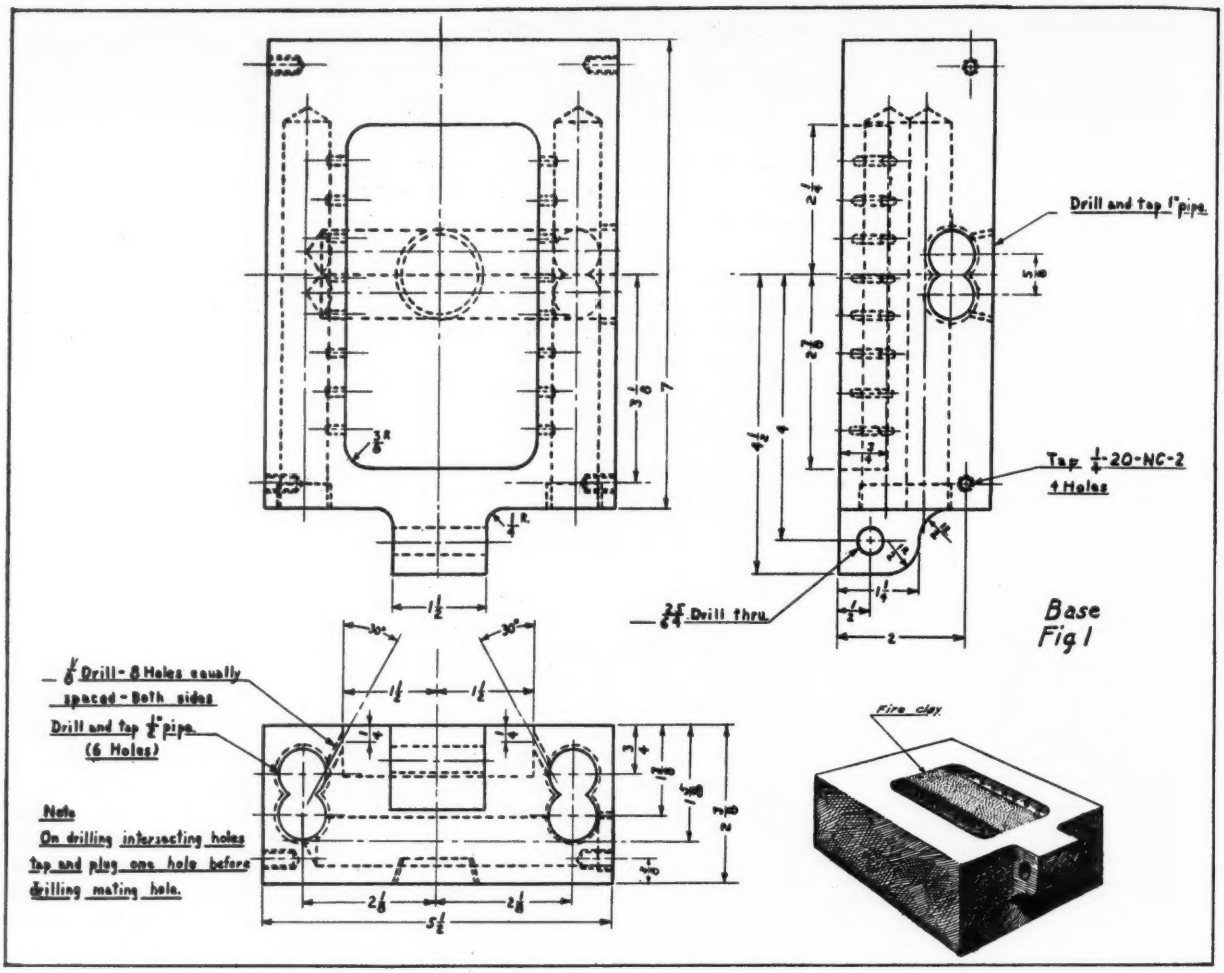
10. After making sure that all chips have been removed from the fuel passages, the remaining ½" pipe plugs may be pulled in tight and the squares cut off.

The hub on the work table and the door catch on the door guide may be either welded or riveted to their respective parts. The work rest is held to the 1" pipe by two ¼" set screws spaced 120° apart to give a three-point bearing. The construction and assembly of the tong rack, work rest, brick frame, door channel, and door catch are clearly shown in the drawings and photographs and will require no further explanation.

In the construction and assembly of the fuel-mixing device, shown in Fig. 2, the 1" pipe nipple is made from 1 5/16" dia. C.R.S. in order to have the ¼" service ell ¼" off center in the end. (This

MATERIAL LIST

Quantity	*Material*	*Size*	*Purpose*
1	C. I.	2½" x 5¾" x 8¼"	Base
2	Stop Cocks	1"	Air and Gas
1	Pipe Tee	1"	Feed Line
1	Service Ell	¼"	Mixer
6	Pipe Plugs	½"	Plug holes in bed
1	Pipe Nipple	¼" x 4"	Mixer
1	Pipe Nipple	1" x 8"	Feed Line
2	Pipe Nipples	1" x 3"	Feed Line
5	Std. one half fire brick	1¼" x 4" x 8"	Sides, Back, Top and Door
1	Boiler Plate	¼" x 16" x 16"	Work Table
1	C. R. S.	⅜" Dia. x 34"	Tongs Rack and Work Rest
1	C. R. S.	⅝" Dia. x 4"	Door Catch
1	C. R. S.	1 5/16" Dia. x 3"	Mixing Nipple
1	Std. Hex. Nut	⅜" N. C.	Work Rest
1	Angle Iron	⅛" x ¾" x ¾" x 42"	Frame
1	Sheet Metal	16 Ga. 8" x 8"	Door Guides & Side Spacers
1	Spring	(to suit)	Door Catch
2 lb.	Furnace Cement (Hydrecon)		Bed
1	C. R. S.	2" Dia. x 1"	Hub for Work Table
4	Button head screws	¼" N. C. x ½"	
12	Button head screws	10-24 x ⅜"	

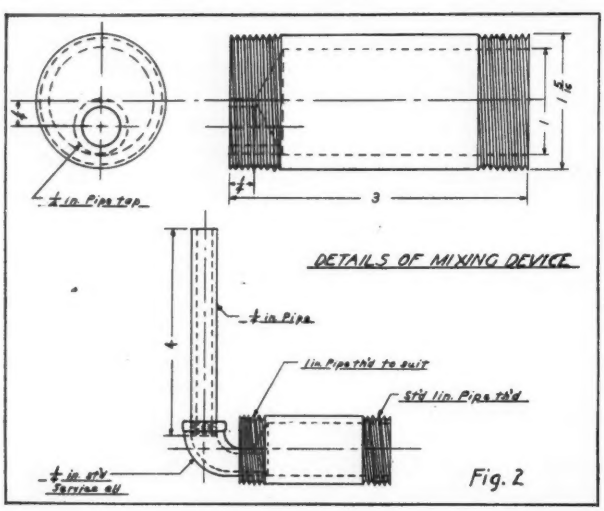

Drill and tap 1" pipe
Tap 1/4-20-NC-2
4 Holes
Drill thru
Base
Fig 1
Drill - 8 Holes equally spaced - Both sides
Drill and tap 1/4" pipe. (6 Holes)
Note
On drilling intersecting holes tap and plug one hole before drilling mating hole.
Fire clay

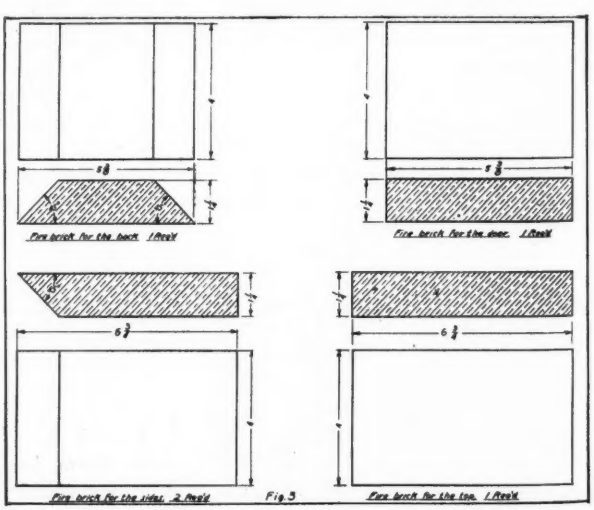
can also be made by welding a plate in the end of a standard 1" pipe nipple.) The thread nearest the service ell is not standard length but must be cut long enough to bring the ¼" service ell approximately central in the 1" tee when pulled in tight with the ¼" service ell in vertical position. Next insert the ¼" x 4" pipe nipple and the 1" x 8" nipple. Slip the work table over the 1" pipe and fasten in position at the correct height with the set screw.

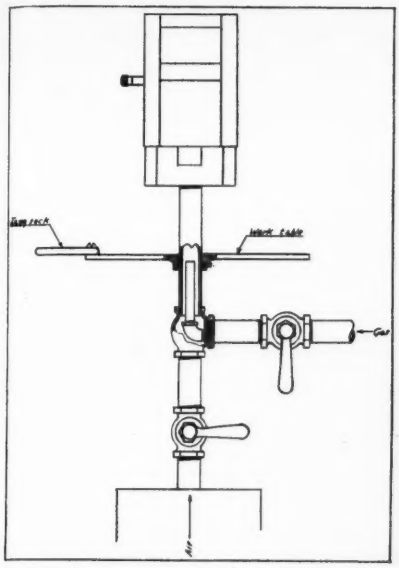
Before putting the furnace into service a fire-clay bed must be laid in the recess provided, leaving the sides at an angle of 30° to allow space for the flame to emerge. (This is shown in the perspective view on Fig. 1.) *Hydrecon*, a patented furnace cement is ideal for this as it has properties which enable it to be put into service immediately. Ordinary fire clay must dry over night or it will explode, due to the water content turning to steam.

A word as to the use of the door catch. Many more elaborate counter weighted devices can be designed. It is a simple matter to raise the door brick with the tongs and hold it with the catch.

The details of the air supply and the

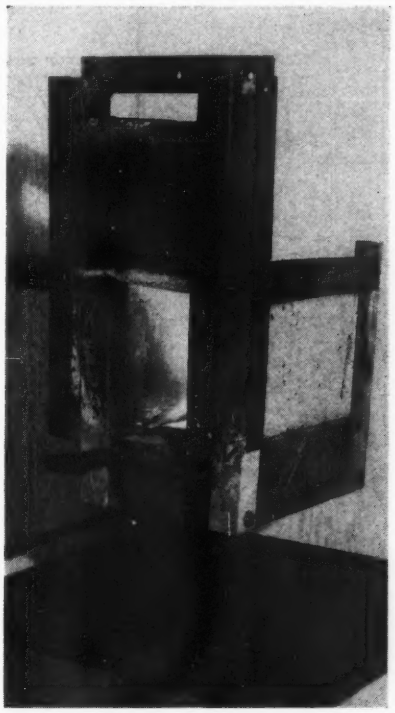


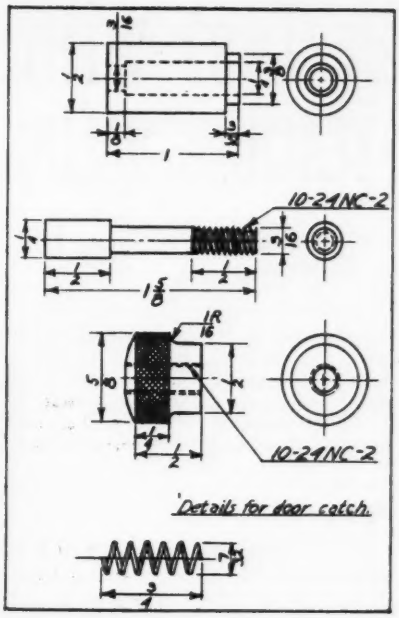




lower frame support were purposely omitted as this is usually a standard unit and may even be a pressure regulator in an air supply line. Any source of air that will provide a sufficient volume of air at low pressure is satisfactory. The furnace shown uses a standard blower.

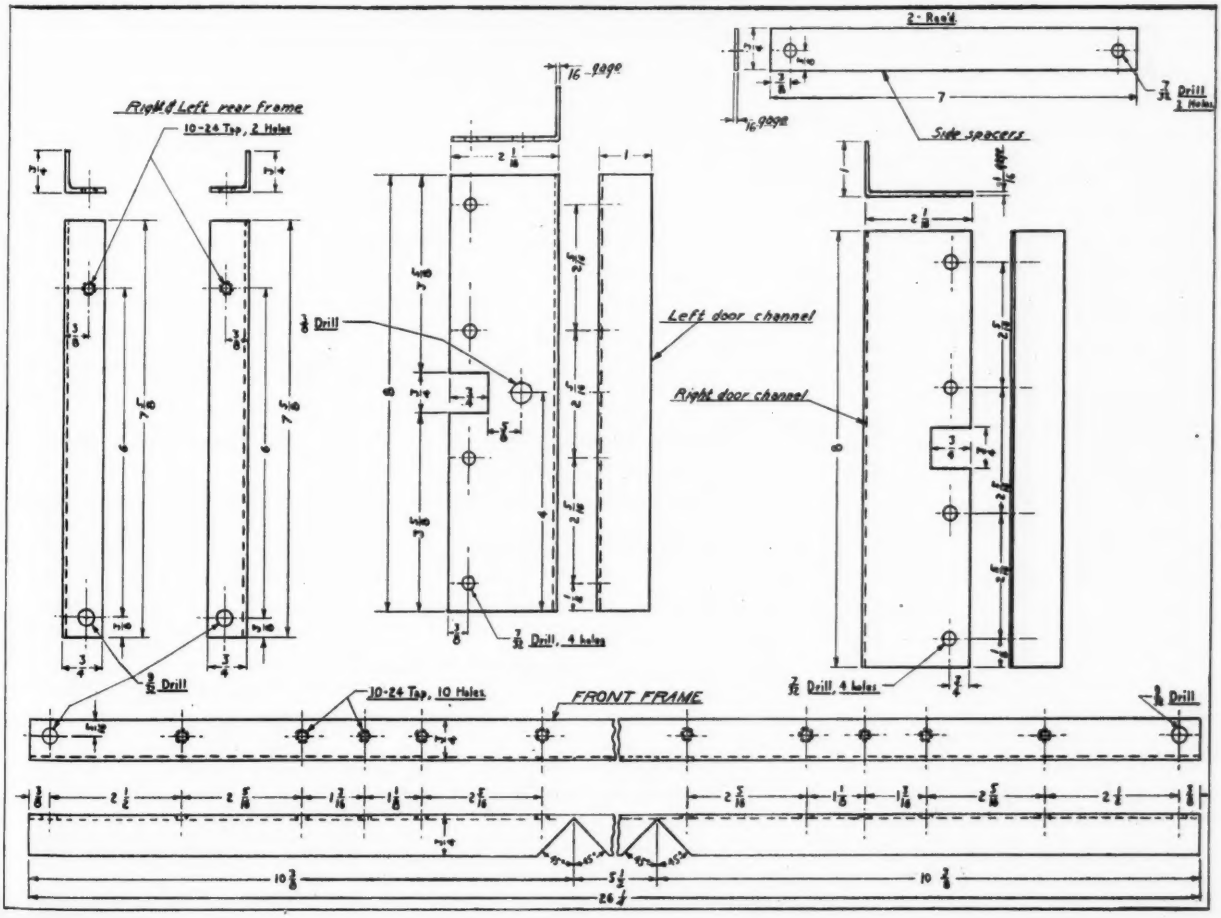
In lighting the furnace, the air should be turned on very slightly; a match or piece of flaming paper placed in the furnace and the gas valve opened slowly. After the gas ignites, the gas and air valves may be regulated to give the de-





sired heat. In shutting off, the gas should be turned off first and the air last, otherwise the gas may back up in the blower and explode.

In drawing the temper on a fairly large job, the top brick may be replaced by a metal plate and the job laid on it.



A Test with TEACHING VALUE

BY *M. F. Foss*

The following test was received with real interest and enthusiasm by students because it not only was used for grading purposes but also served to show them their weaknesses. M. F. Foss teaches in the Department of Industrial Arts Education, Miami University, Oxford, Ohio.

TEACHERS are familiar with tests which measure a student's knowledge, ability, or growth. These tests have a definite place in the educational system and as long as teachers are required to assign grades and rank they will play an important role.

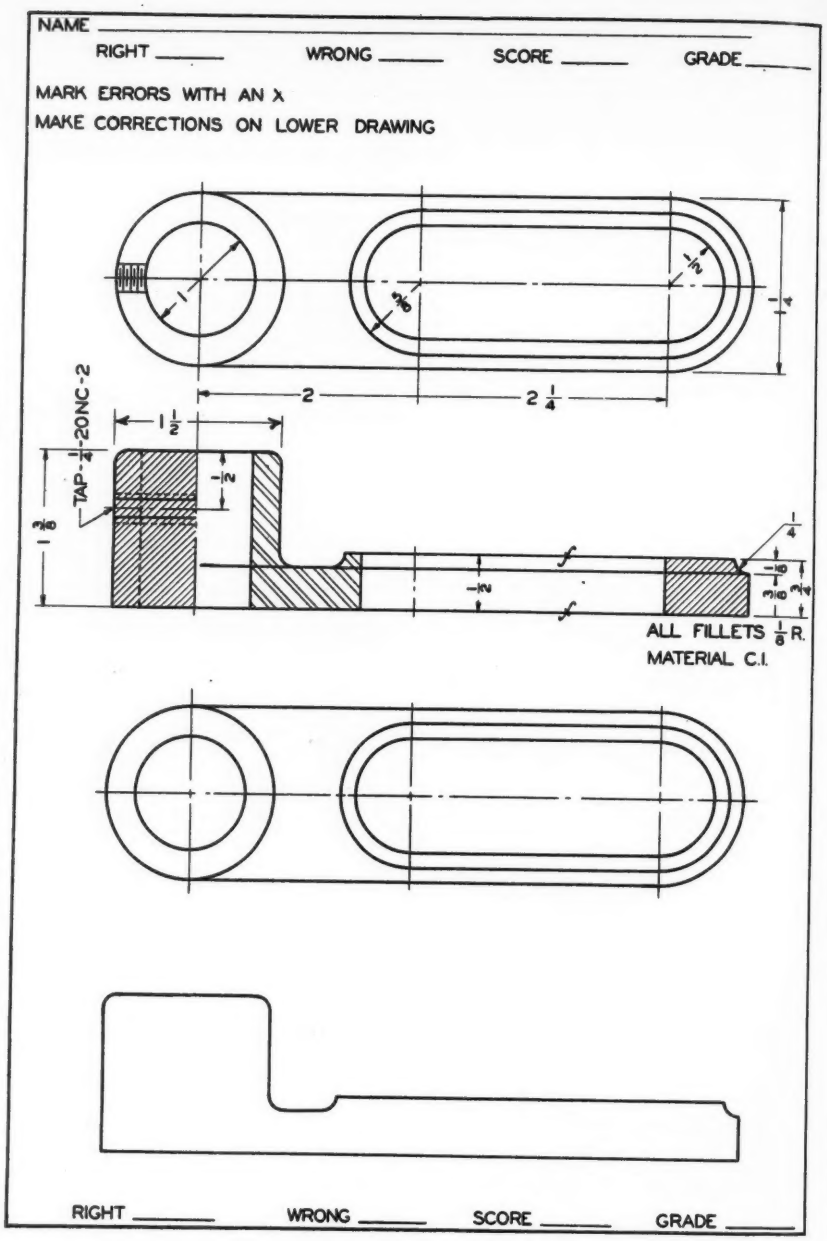
Tests as teaching devices are not so common, but can be equally important. Tests used in this way tend to focus student attention on a definite point. Class discussion centers on the reason for a certain procedure, rather than on mere memorization. Borderline cases are made clearer after reasons are given and discussed pro and con.

This checking test for drafting technic and procedure has proven quite satisfactory as a teaching device. It has also proven to be popular with the students. The whole purpose has been to have the student understand the reason for preferred procedures.

In the first half of the test the student marks errors with an *X*. In the second half of the test the student sketches what he considers the correct drawing. Each paper is carefully gone over by the instructor and returned during the following class period.

The correct drawing is sketched on the blackboard and explained point by point. Students are encouraged to ask questions or present discussion of any point.

In grading, the test has been scored as two separate tests. In each case the number of incorrect answers has been subtracted from the number of correct answers to determine the individual score. Grades have been assigned on the position of the individual score. While the grades may have some usefulness the main value of the test has been to improve the quality of the students' drafting plates.



Key for Checking Test

X 1. Dimension is unnecessary.

X 2. Dimension line is unbroken for dimension figure.

X 3. Dimension figure is incorrect; should be 1½.

X 4. Diameter of slot should be given rather than radius of ends.

X 5. Incorrect symbol; symbol used is for sectional view.

X 6. All notes should be placed horizontally.

X 7. Arrow-head is missing.

X 8. Arrow-head is missing.

X 9. Arrow-head poorly made.

X 10. Arrow-head poorly made.

X 11. Dimension given from an unfinished surface.

X 12. Dimension placed inside of drawing.

X 13. Tapped hole should not be cross-hatched between the solid lines.

X 14. The dotted line (edge of the one inch hole) should be solid.

X 15. The tapped hole should not extend beyond the solid line.

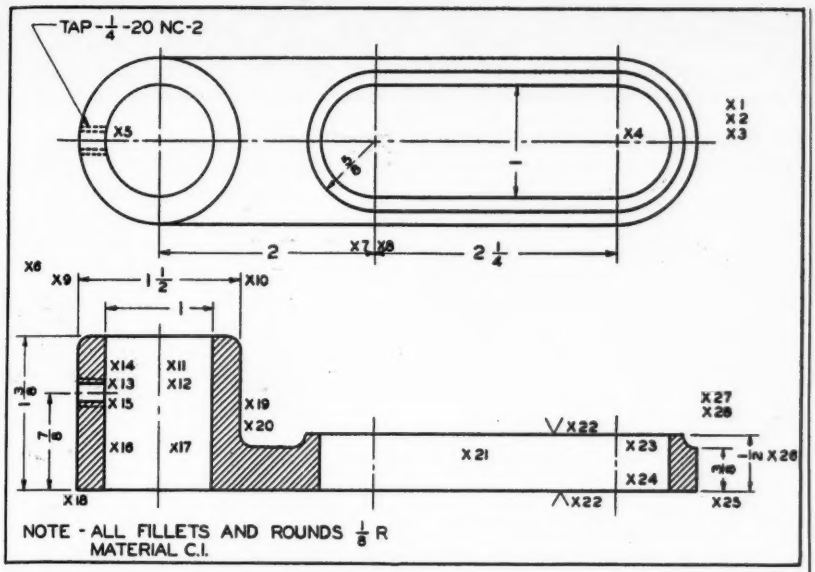
X 16. There should be no cross-hatching between the edge of the hole and the center line.

X 17. The solid line should be removed in a section view.

X 18. Extension line touches drawing.

X 19. The cross-hatching should be in the same direction as the ends since only one piece is being cut.

X 20. The cross-hatching should be



uniformly spaced since the material is cast iron. The cross-hatching used represents steel.

X 21. This dimension is unnecessary since it is given on the outside.

X 22. The A.S.A. finish mark is recommended.

X 23. The solid line should be a center line.

X 24. The end of the slot in the front view should be in line with the end of the slot in the top view of the drawing.

X 25. Arrow-head is missing.

X 26. The height should be ½ rather than ¾.

X 27. All fillets are ⅛ rather than ¼.

X 28. Fraction lines should be separate from dimension line.

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Converting the American Housewife to War Worker

BY *George C. Sherwood*

MACHINE-SHOP INSTRUCTOR,
PHILIP SCHUYLER HIGH SCHOOL
ALBANY, NEW YORK

Right—Instructor Sherwood checking measurements on a 4" end mill cutter being machined by Mrs. Koss.

LAST fall I needed some large inserted-tooth end mills for some of our work and discussed the need for them with several of the women who had enrolled in our machine-shop course the previous July. Much to my surprise, one of the trainees, Mrs. Nettie Koss, spoke up and said, "Mr. Sherwood, if you will make a sketch of what you want, I will make it for you."

Not too serious about it but not wanting to discourage such enthusiasm, I went back to my desk and made a sketch of what was wanted. A few minutes later, I gave it to her with the remark: "There you are, go to it."

Undaunted, she got the stock from the stock clerk on requisition and went to work.

The shank was made first to fit the spindle of the milling machine, leaving the head of the shank 1¾" x 2" with a 3° taper. A ⅝" tapped hole was put in the end, fitting a cap screw tight into the hole. The head was faced off and centered. The head was then made from a piece of cold rolled steel 6⅛" in diameter, put in the chuck, faced off, drilled, and recessed to allow for washer and cap screw. The head was then put on the shank.

The piece was then put in the lathe between centers and the head was turned to 6" in diameter. The work was then taken to the miller where twelve ⅜" x ⅜" slots were milled for the cutters. A band, ½" x 1", bored to 5.987", was shrunk on, holes were drilled and tapped for Allen set screws, and ⅜" high-speed steel tool bits were used for cutters.

After the cutters were ground the end mill was put in the miller and tried on a 6" angle iron. It worked so well that Mrs. Koss has made two other cutters, a 4" with 10 teeth (see picture above) and a 10" with 16 teeth (see front cover).

Needless to say, Mrs. Koss had no difficulty getting a job and is now working 48 hours a week for the Berkshire Motors Co. This firm converted its large garage into a machine shop and is doing war work.

Mrs. Koss still has time to do her house work and come back to school two evenings a week from 7 to 11 P.M., working on inspection and cam layouts.

This experience has convinced me that, given a chance, many American housewives can and will make good war workers for America.

On July 1, we began a war-work training class for women. Twenty signed up, mostly housewives ranging in age from 19 to 50. None of them had had any previous experience in shop work. The class was in session 40 hours a week for eight weeks.

We found some of the women extremely interesting in the manner in which they took up the work. We gave them instruction on the lathe, milling machine, grinder, shaper, planer, drill press, hardening and tempering, and some layout work. Some were particularly clever and all are now employed on war work as is Mrs. Koss.

Our shop runs on an "around-the-clock" basis, starting at 8:30 A.M. with two regular high-school classes until 3:30 P.M. A defense class enters at 4 P.M. with a few coming at 7 and working until 11 P.M. Another class begins at 11 and works until 7 A.M. We have five machine instructors and three for related work—blueprint reading and mathematics. The war-work classes are now 50 percent women.

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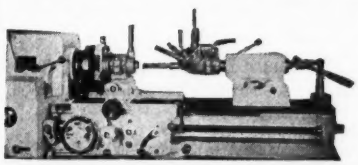

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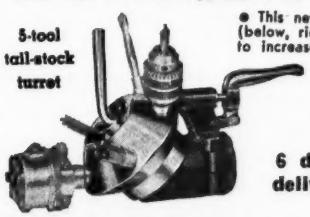

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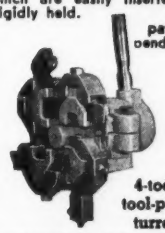

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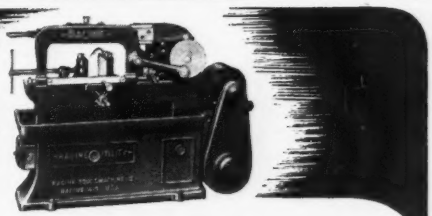

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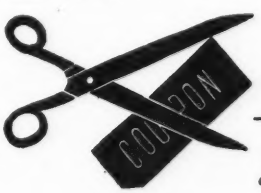

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Can blueprint reading be taught as a subject in itself, or can it best be taught through learning to draw?

Says THOMAS DIAMOND, professor of vocational education, University of Michigan, Ann Arbor:

We who are concerned with what we are pleased to call practical education have frowned upon Greek and Latin as subjects which we have felt to be unsuitable for the training of a person for an industrial pursuit. At the same time, we may be willing to concede that both of these subjects may become valuable when studied by individuals who have a definite purpose in doing so. Similarly, learning the technics of machine drawing are valuable to some people, but, to countless thousands these technics are relatively of little importance. For example, the mechanics in the machine shop, pattern shop, or foundry may be excellent craftsmen and still not have the ability to make the drawings they use. It is admitted that it would be a fine thing if they could draw, but it would be equally good if they could write an acceptable piece of English composition. However, since neither of these accomplishments are necessary in their work, they fall into the class of "desirable" subject matter, but are not found among those considered essential in the training of a mechanic.

Those who insist that learning through drawing is the only way to develop ability in reading drawings are likely to be teachers of drawing who have acquired the quaint notion that they have a vested right in the task of teaching blueprint reading. Anyone will concede that reading can be learned through drawing, but to say that it is the only way, or even the best way, seems to be overstating the case. The writer has no desire to question the ability of the drawing teacher to teach reading. Neither does he question the value of drawing. The only point to be made is that blueprint reading may be taught quite successfully without having the pupil go through the experience of mastering the technics of drawing.

Says GEORGE A. WILLOUGHBY, head, department of industrial arts, Michigan State Normal College, Ypsilanti:

Although I believe that it is desirable for both men and women to be able to do mechanical drawing work, I am sure that blueprint reading can be taught as a subject in itself. I have had many mechanics in class in evening school who read blueprints for years but who came to school to learn to draw so they could express themselves in the language of industry.

Reading blueprints consists of two essential phases, visualizing the views represented and interpreting what is indicated on the views. Both of these can be learned with very little or no drawing if necessary, in limited time.

Says ARTHUR B. MAYS, professor of industrial education, University of Illinois, Urbana:

With reference to the question: "Can blueprint reading be taught as a subject in itself, or can it best be taught through learning to draw?" my answer, based on considerable experience, is that it can be very easily taught as a subject in itself. A person who has had a long and thorough course in mechanical drawing of course experiences no difficulty in reading blueprints which are not of such highly specialized types that his course did not include the type of work they represent. However, it is certainly not necessary to take a course in mechanical drawing to be able to read a blueprint.

I have found that one of the best places to teach blueprint reading is in the shop. Boys learn it in the shop, under careful supervision and instruction, almost without realizing that they are learning to read blueprints. The shop experiences, of course, give reality to the blueprints, and that is possibly the reason that the shop seems to be such an easy place in which to teach blueprint reading.

Says ROY A. BARTHOLOMEW, Public Schools, Iowa City, Iowa:

In a junior or senior high school, it is probable that a combination of the two methods would be the most efficient. I believe that blueprint reading can be taught in connection with industrial-arts shop work or with trade training just as well as in combination with drawing.

Blueprint reading may be learned incidentally in a course in drawing or in shop work but it should be learned much more quickly if it is specifically taught. If the immediate objective is to learn to read blueprints for some definite trade, it would seem a waste of time to make many drawings. There might be considerable value in doing or at least seeing certain shop work and drawing which would give more meaning to the blueprint reading.

Says W. W. ROGERS, Edison Technical and Industrial High School, Rochester, N. Y.:

For the most purposeful teaching, blueprint reading is best taught as blueprint reading, not as mechanical drawing. Blueprint reading teaches the essential factors of projection, form, dimension; and related trade specifications without the encumbrances of learning the various drafting technics and manipulations.

Blueprint reading can be taught at a learning rate and with teaching methods that will hold the interest of the learner. Results may be measured objectively. It offers, to students of machine-tool, welding, sheet metal, and allied aircraft trades the most effective means of understanding the various factors encountered in reading blueprints of their respective trades.

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IN THE *Morning Mail*

● Brief comments about SCHOOL SHOP and the field it serves are invited. Address the Editor, SCHOOL SHOP, Ann Arbor, Mich.

Gentlemen:

In behalf of the corps of industrial arts teachers of the city of Seattle, Washington, I wish to express our appreciation to you and your staff for the fine magazine sent us this year of 1942.

A resolution made and passed at the December meeting of the Industrial Arts Club of Seattle gave me the honor of presenting our expression. For your benefit I might say hardly a meeting passes without some one of the fellows quoting a spicy bit of information from SCHOOL SHOP. As for me personally I look forward with anxiety to what help the big little magazine will bring each and every month.

The hope and prayer goes forth for you and your magazine this beginning of a new year. May it yield only pleasures and prosperity.

PURL STONE, President,
Seattle Industrial Arts Club,
Seattle, Wash.

Gentlemen:

Your little magazine for its size is without a doubt doing a great service. Each month I pick an article or two and present it to my Advisory Board for Vocational Education for their homework reading. I believe they look forward to this addition to my regular reports as I know it is a great help to me.

WESLEY H. DIRKS, Director,
Vocational Education for National Defense,
Baldwin, N.Y., High School.

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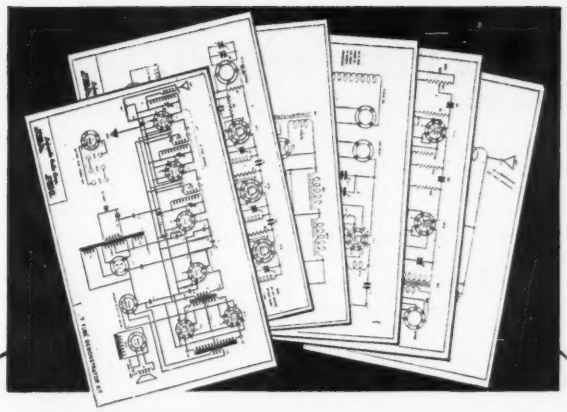

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instructional resources

Inquiries concerning materials described in these columns may be addressed to SCHOOL SHOP, Box 100, Ann Arbor, Mich., and will be passed on to the proper firm or person.

Manual of Elementary Machine Shop Practice. Phillips. Minneapolis: Burgess Publishing Co., 1942 (new printing). Pp. iv + 199. $2.50.

This workbook-style text is divided into two parts: 73 unit operations and 26 information sheets containing facts bearing on the operations. Each operation unit consists of numbered steps in mastering a technic, and much informational material has been included in these sheets. References are also made in operation units to corresponding information sheets. Subjects covered include layout, bench work, lathes, millers, shapers, drill press, measuring, safety, and general operations. Illustrated with drawings.

Ernest C. Phillips is professor of mechanical engineering, University of Missouri, Columbia.

Airplane Models and Aviation. Brown. Boston: D. C. Heath & Co., 1942. Pp. 43.

Besides containing actual instructions and plans for the construction of model planes, this book is a manual for the shop teacher wishing to carry on a model-building program. In five units, discussing gliders, stability, propellers, wings, and theory of flight. Theory is simply explained and demonstrated through simple suggested experiments. Illustrated with drawings and photos; glossary of terms; bibliography.

Willis C. Brown is supervisor of construction of aircraft models, Boston, Mass., Public Schools.

Oxy-Acetylene Welding and Cutting. Giachino. Peoria: The Manual Arts Press, 1942. Pp. 196. $1.96.

Units covering basic welding information, welding technics in general, and the welding of special materials and forms, aircraft welding, and flame cutting. Units also on identification of metals and on expansion and contraction. Each unit contains information needed in the exercise, drawings or photos, and questions on the exercise. Tables and charts; index.

J. W. Giachino, now on leave with the Navy, is professor of industrial education, Western Michigan College of Education, Kalamazoo.

Principles of Aircraft Engines. Shields. New York: McGraw-Hill Book Co., 1942. Pp. ix + 378. $1.88.

The second in the McGraw-Hill Introductory Aviation Series. The purpose of the book is to interest students in aviation and to supply as much information about it as possible. Following a chapter on power plants in general, each phase—carburetion, ignition, instruments, propellers, etc.—is taken up separately. Chapters also on engine operation and on servicing. Chapters conclude with summary, questions, and assignments. Photos, drawings; index.

Bert A. Shields, Lt. Comdr., U.S.N.R., is chief instructor in charge of civilian pilot training, Polytechnic Institute of Brooklyn, N.Y.

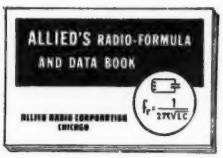
Mechanical Drawing. Kenison, McKinney, Plumridge. Chicago: American Technical Society, 1943. Pp. 330. $2.00.

Text begins with chapters on instruments and materials, lettering, geometrical definitions and problems, symbols and conventions, and working drawing principles. Following chapters are on projection, hidden parts, sections, drawing to scale, intersections, isometric projection, etc. Each chapter contains drawings, problems, and exercise plates. Index.

Ervin Kenison, S.B., is professor emeritus, Massachusetts Institute of Technology; James McKinney is educational director, the American School, Chicago. The revision was made by Tom C. Plumridge, head of the drafting and design department, the American School.

Allied's Radio Formulas and Data Book. Cooke. Chicago: Allied Radio Corp., 1942. Pp. 40. No charge.

This handy pocket-size booklet contains all sorts of data of value in radio work, including algebraic formulas, trigonometric relationships, ohmmeter formulas, radio color codes, 3-place log table, radio abbreviations, mathematical symbols, etc. Will be especially handy for pre-induction radio training.



Nelson M. Cooke, editor of the book, is chief radio electrician, U. S. Navy, and author of *Mathematics for Electricians and Radio Men*.

John Wiley Announces Pre-Service Texts

Ready February 1 are texts for the five phases of pre-induction training from the presses of John Wiley & Sons, Inc., New York. Each book is especially prepared for pre-service training and conforms strictly to the War Department outlines for pre-induction courses. All books emphasize *how it works, why it works,* and *how it is made,* in that order, thus making for greater teaching efficiency. In some cases 30 percent of the content is devoted to illustrations and diagrams.

New Catalogs List Ghirardi Radio Books

The famous Ghirardi texts and handbooks on basic radio fundamentals and on radio testing and repair are listed and described in new catalogs of the Radio & Technical Publishing Co., 45 Astor Place, New York, N.Y. These are available on request to the publisher.

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A large folder explaining production illustrations accompanies each announcement pamphlet sent to all who enter. *Teachers,* if you have not already received one of these educational brochures, send for one today! Contest runs from Sept. 1942 until March 1943. There are many prizes consisting of scholarships, money and gifts but these are a minor consideration in view of what this contest can do for the student in pre-industry training consistent with our nation's needs.

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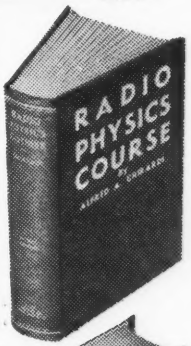

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THIS lawn chair was developed for several reasons. One was the demand from students for a chair strong enough to use on a lawn and light enough to move about easily. After some designing and experimentation the chair herewith illustrated and described resulted. The second reason for developing the lawn chair was that we had accumulated a great many odds and ends of lumber, left over from stage productions and from certain maintenance jobs. These odds and ends had accumulated over a period of two years. We felt that the material was too valuable to throw away and still it was not good for most projects because it consisted mainly of narrow strips and of cheap lumber. The project is ideal to use at the present time as it can be built entirely of salvaged lumber.

No board need be thicker than ¾" dressed, nor is it advisable to have them much heavier since this would increase the weight of the chair too much. It is not advisable to have any boards thinner than ½" and these should be sound. Screws are recommended as the only fasteners to hold the chair together. Experience has taught us that nails will sometimes work loose and catch on clothing causing tears and runs. Properly set screws do away entirely with this possibility.

Merely because this is a piece of outdoor furniture is no reason for doing anything but the best in the way of workmanship. Have all boards planed and sanded so well that there is no chance of a rough spot to catch on hosiery or light summer clothing.

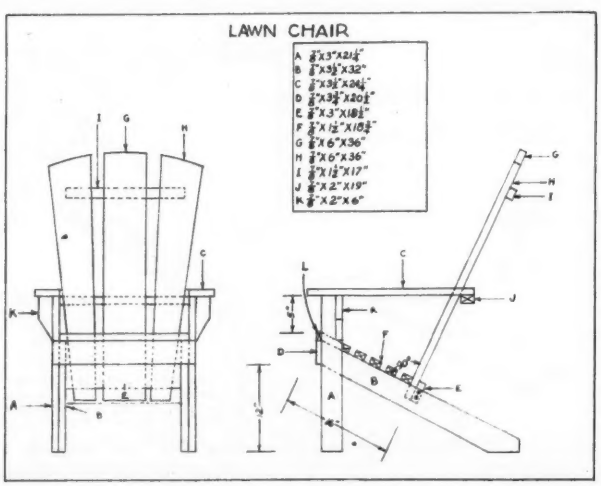
Operations:

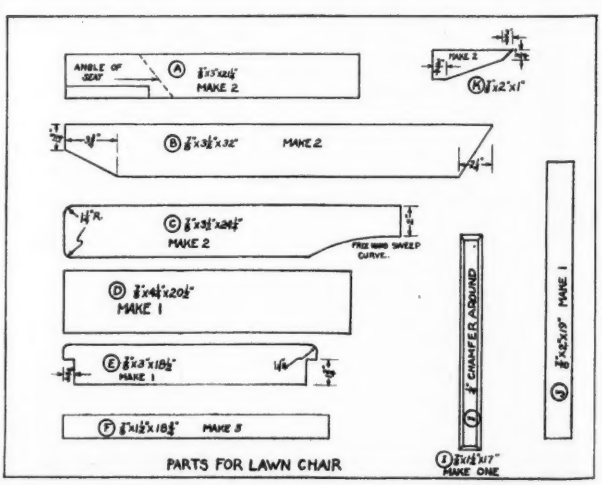
1. Make out bill of material.
2. Make full sized layout of each piece.
3. Saw out each piece to rough size.
4. Saw parts *A, B, D, F, I,* and *J* to finish size with allowance for planing.
5. Saw parts *C* and *E* to finish size, cutting curves with jig saw.
6. Plane all pieces on all sides until they are perfectly smooth. Remove sharp edges with the plane and sandpaper each piece very carefully.
7. Chamfer part *J* all around on one side.
8. Locate all screw holes, bore pilot holes and countersink.
9. Assemble parts *A* and *B* first.
10. Fasten parts *I* and *E* in position next.
11. Assemble parts *C* and *F* and fasten to the parts already assembled.
12. Make a trial assembly of parts *G* and *H* and lay out the curve of the back.
13. Take parts *G* and *H* off and cut to desired shape, plane carefully, sandpaper, and bore pilot holes for screws.
14. Assemble permanently, placing part *J* on back as shown in drawing.
15. Touch up with sandpaper making certain that no rough spots exist around the screws, on ends or edges.
16. Prime the completed chair with a coat of housepaint of any color; when dry sand carefully again.
17. Finish with one or two coats of good quality porch or deck paint. When this is thoroughly dry, sand lightly again and the chair is ready for use.
18. It is well to remember that the end grain of these boards should be well treated with several coats of primer to resist the weather as much as possible.

This project can be built by ninth-grade general shop boys and can easily be finished in time allotment of three hours per week in a five-unit shop. It is an excellent method of using odds and ends of lumber that collect about a school shop and is generally of interest to a number of boys.

Front Cover . . .

This picture shows Mrs. Koss, mentioned in the article on page 10, measuring the teeth on a 10" end mill she made in a war training class. This and the photo on page 10 were by D. J. Chiore.





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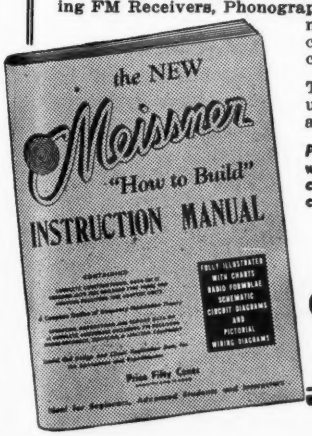
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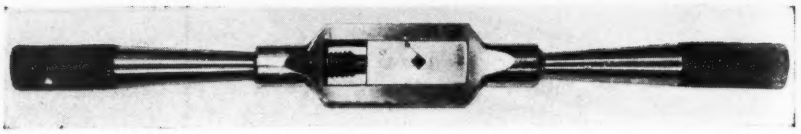
Tap Wrench

BY *Glen B. Christy*



This project in operation-sheet form fits in nicely with the author's project on page 12 of last month's SCHOOL SHOP, a die holder. The tap wrench is suitable for advanced students. Glen B. Christy teaches machine shop at Lane Technical High School, Chicago, Ill.

MAKING a tap wrench requires the knowledge and patience possessed by an advanced student. It appeals to them because it is a very useful article. The wrench described herewith will handle taps as large as 5/8".

The body of the wrench may be shaped in the miller and the opening in the body can be milled with an end mill and filed square. If a surface grinder is available, the problem of grinding the face of the wrench body can be added.

The drawing gives the dimensions you will need to lay out and make the tap wrench. Keep the drawing in front of you and refer to it for each dimension. This operation sheet gives you the operations in their proper sequence. If you have a question, ask your instructor.

Wrench Body

1. Cut C.R.S. 7 5/16" x 1¼" diameter for body of tap holder. Center drill and countersink.
2. Turn to dimensions between centers. Set compound rest to cut 45° angle. Use formula:

$$\frac{D - d}{2} \times \frac{L \text{ stock}}{L \text{ taps}} = \text{tail stock set over}$$

3. Drill 5/16" for 3/8"—16—N. C. thread.
4. Tap 3/8"—16—N. C.
5. Counter bore threaded end to 7/16"—½" deep.
6. Counter sink counter bore end to place between centers on the lathe.
7. Knurl the handle.
8. Block to proper height and clamp in shaper vise.
9. Shape one flat side to approximate shape.
10. Turn over, lay flat on block, and clamp in vise.
11. Shape other side to approximate opposite side.
12. Be certain that same depth is cut on one side as on the other.
13. File and polish these sides to correct shape.

Cut Opening in Body

1. Copper plate flat sides.
2. Lay out a center line on the flat sides the length of the flat sides. Lay out a center line across the flat sides.
3. Use these center lines and lay off an opening 2" x 9/16".
4. Optional end mill and file opening.

4*a*. Lay out another rectangle, 3/16" inside the 2" x 9/16" rectangle, which will be 1⅝" x 3/8".

5. Make a center-punch mark on corner of inside rectangle.
6. Set dividers at 7/32" and using punch mark as center, scribe an arc across the inner rectangle. Punch mark this intersection.
7. Use the last punch mark as a center and proceed as in No. 6. Continue until the entire inner rectangle is center-punch marked.
8. Drill each center-punch mark 3/16". Be sure to drill at each corner when possible.
9. Make a center punch mark 5/8" from inner rectangle on center line.
10. Set dividers at 11/16" and mark off and center punch on center line.
11. Drill each mark with 5/8" drill. Do not allow drill to cut outside inner rectangle.
12. Remove metal with chisel and file to line 2" x 9/16".

Movable Arm

1. Cut stock ¾" x 5½".
2. Turn to size as indicated.
3. Cut 3/8"—16 N. C. thread—try thread in body.
4. Knurl and cut off. Small end should be cut same angle as drill. The length must be accurate.
5. Cut stock for fixed jaw ½" x 5/8" x 1".
6. Cut stock for movable jaw 13/16" x ½" x 5/8".
7. File and fit in opening.
8. File tap holder openings.
9. Drill to exact depth for small end of movable arm.
10. Drill for pin.
11. Drill body 3/16" for ¼" No. 20 N. C. set screw to hold fixed jaw.
12. Drill fixed jaw.
13. Assemble.
14. File and polish for finish.

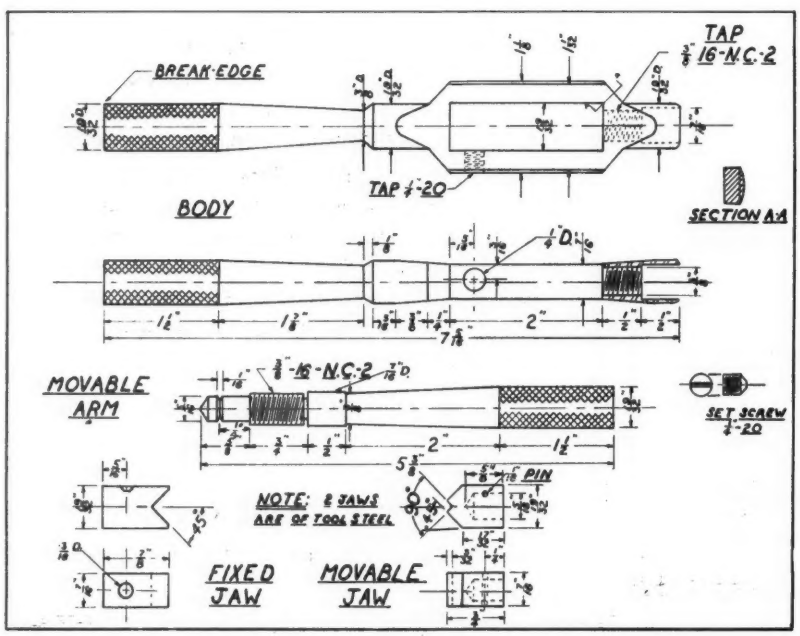
Fixed Jaw

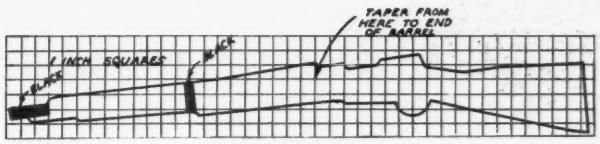
1. Can be made of tool steel or C.R.S.
2. File or mill the jaw to size for an easy press fit.
3. Spot jaw for set screw through hole in body of wrench, or drill body of wrench while fixed jaw is in place.

Movable Jaw

1. Made of tool steel or C.R.S.
2. File or mill the jaw to size for an easy sliding fit.
3. Drill 5/16" hole 5/8" deep for movable jaw. (This must be accurate.
4. Drill hole for retaining pin.
5. Harden tool steel and draw to proper hardness.
6. Polish.

The ends of the two handles may be drilled to make a lighter tool.





Johnny Get Your Gun

BY *Paul G. Lackey*

With rifles at a premium these days, Washington, D.C., High School Brigade members found themselves without the old Springfields for drilling purposes. Paul G. Lackey, who teaches at Eastern High School in the capital, made these substitutes with student help.

THE High School Brigade in Washington, D. C., is a uniformed organization of approximately 2500 cadets. The boys drill for an hour and a half twice weekly.

Last June the War Department had to recall the Springfield rifles that had been loaned to the organization. At the suggestion of Principal Charles Hart of Eastern High School, a wooden copy was made of a good quality fir. While it weighed but 3½ pounds in contrast to the 8½ pounds of the Springfield, it seemed the best possible substitute for the emergency. During the summer, 2000 of them were made with student help.

A template was made to the exact size of the Springfield rifles. The guns were made from 2″ x 6″ clear fir. The 2″ x 6″ lumber was cut into 6′ lengths which produced two guns. The guns were sawed on the bandsaw two at a time,

and the barrels were tapered to ¾″ sq. on the end, both sides being cut evenly with the jointer. The faces and edges were planed and spokeshaved by hand to remove all machine marks. The trigger guard was tapered with a wood chisel. Next all four corners of the gun stock were shaped with a 1″ radius rounding over cutter in a drill press. The cutter was made in the shop as one of that size could not be purchased with the stop pin or tip on the end. The drill press was geared up to turn about 7000 R.P.M. All remaining corners on the barrel were rounded over with a ⅜″ rounding over cutter in a Stanley router shaper. Then the entire gun was sanded.

An oil finish was used as the gun would probably be used in all kinds of weather. A dip bath was made up of linseed oil, asphaltum paint for color, turpentine, and drier. The guns were dipped and left to soak up all the oil they would, placed on a rack to drain, and before the mixture became sticky the excess was wiped off. They were allowed to dry and then trimmed with black lacquer.

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Ice Creepers

BY *N. H. Poole*

This project will not interest SCHOOL SHOP readers in sunny climes so much. We refer them to the project on page 18. Our icebound readers will find this simple project useful in showing how the welding torch can be utilized for instructional purposes. N. H. Poole teaches in the Emmerich Manual Training High School, Indianapolis, Indiana.

OFTEN boys in oxy-acetylene welding think that the welding torch can be used only for welding. The welding torch can also safely be used for heating metal for easy shaping and for such heat-treating operations as case hardening, annealing, and for hardening and tempering.

It is the purpose of this article to show by a simple project, *ice creepers*, how in addition to bronze welding the torch can be used for heating, for shaping, and for case hardening.

Materials needed are:

2 pieces of mild steel band iron ⅛" x 1" x 4½".

6 pieces of 3/16" round iron ¾" long or 6 3/16" by 1" soft iron anvil rivets.

1 pair woven book straps.

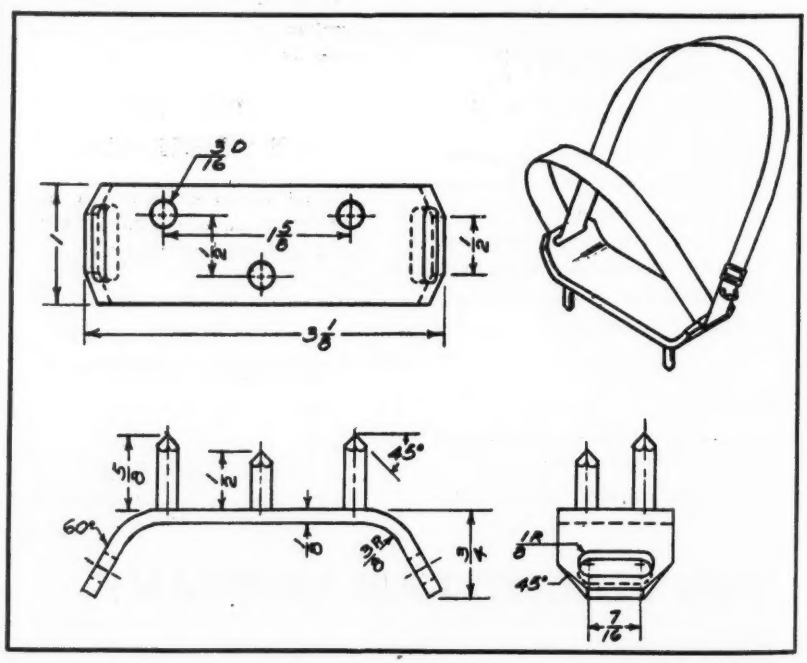
Short length of bronze welding rod.

Small amount Kasnit case hardening compound.

Procedure:

1. Lay out all dimensions as per drawing.
2. Drill holes and cut slots.
3. File all outside edges round.
4. Place the metal in a vise, use torch and apply heat where sides are to be bent. Bend each side to 60°.
5. Bronze weld pins in place. Cut to proper length and file four-sided point.
6. Heat pins with torch to cherry red color, dip points in Kasnit, reheat points, and plunge in water.
7. Clean off scale, being careful not to cut through the "case." Give the creepers a coat of black flat paint.
8. Install the book straps so that one strap goes over the instep of the foot and the other strap over the heel.

Wanted: Articles on electricity, radio, aviation, and pre-induction courses.—*Editor*, SCHOOL SHOP.

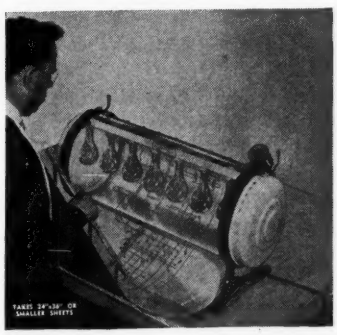


. . . news from INDUSTRY

For items listed in this column, readers may address the firm named or write to News from Industry Dept., SCHOOL SHOP, Box 100, Ann Arbor, Michigan.

No Skill Needed for Victoray Blueprinter

Any inexperienced operator can make blue or black-and-white prints on the Victoray blueprinting machine made by Victoray Corp., Battle Creek, Mich.



Only three minutes are required for the making of a print, which can be done in ordinary daylight. Prints are inexpensive, only one cent per square foot. Illumination is supplied by regular incandescent bulbs, good for 1200 hours of printing and renewable for $1.60.

The low selling price of the Victoray is made possible, say the makers, by efficient construction methods and simple design. Information may be had at no charge by writing SCHOOL SHOP or Victoray Corporation, School Dept., Battle Creek, Mich.

Comet Introduces Control Demonstrator

A new aircraft control demonstrator, the "Air-O-Trainer," is now in production by Comet Model Airplane & Supply Co., Chicago. The device teaches the fundamentals of airplane control, and is intended primarily for use in schools. The "Air-O-Trainer" is made chiefly of wood, using a minimum of strategic materials, and may be purchased in complete or construction-kit forms. An illustrated instruction booklet accompanies the demonstrator. For information write SCHOOL SHOP or Comet Model Airplane & Supply Co., 129 W. 29th St., Chicago, Ill.

St. Paul Firm Offers New Power Saw

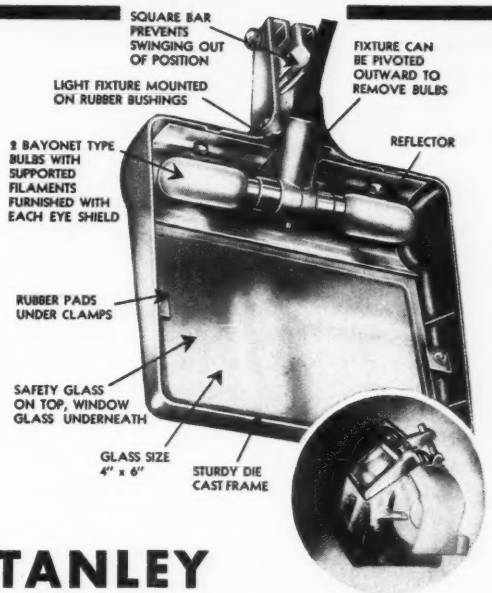
Newly-designed for hard usage in school and industrial shops, the Keller No. 3 Hy-Duty power hack saw has just been introduced by Sales Service & Manufacturing Co., St. Paul, Minn. The new saw is a stronger version of the firm's other models, with many improvements, and will accommodate a heavy-duty four-tooth blade.

The makers report up to 250 cutting hours per blade from this saw with about five resharpenings. For further information, address SCHOOL SHOP or Sales Service & Manufacturing Co., 473 N. Cleveland Ave., St. Paul, Minn.

Starrett Offers New Drill & Tap Calculator

L. S. Starrett Co. offers to instructors a new dial-type calculator which shows corresponding sizes of taps and tap drills and the number of threads per inch. The indicator also carries a dial of decimal equivalents. The handy pocket-size indicator is available without charge; address SCHOOL SHOP or L. S. Starrett Co., Athol, Mass.

PROTECT STUDENTS' EYES FROM GRINDING HAZARDS!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from WASHINGTON by WILLIAM PACA

THIS month your correspondent will ask the school shop teacher and administrator to lift up their eyes from the shop bench or textbook and to look upon three widely different, perhaps even unrelated, subjects: physical fitness, social security, and post-war planning.

These three topics may have nothing in common and, on the surface, they may have little interest for the vocational educator. But officials in Washington are talking about them and they invariably associate the school shop teacher with them.

● Not vocational skills and technics, but the physical fitness of vocational pupils was the concern of the moment of one top vocational officer in Washington, when I spoke to him. "Isn't that a problem for physical education departments," I asked. And the answer was that too often many vocational instructors and pupils, in their eagerness to develop skilled hands, forget the importance of a strong body.

Vocational students, together with other youth, will be called to join the armed services. They will need strength, endurance, stamina, and agility—even though they are engaged in technical Army and Navy jobs and not in fighting. Many an electrician or radio operator has lost his life in this war, because he could not "swim it out" or slide swiftly down the ropes of a burning ship. Naval and military authorities report that American youth have been found lacking in physical characteristics important in war. In toto, we Americans seem to be strong in leg muscles, for example, but could improve our swimming and are short of wind.

The physical fitness program, launched by the U. S. Office of Education, War, Navy, and other agencies, seeks to toughen our muscles and to develop our agility. Can the vocational school participate in this great movement? It should find time to do so, says one Washington educator, who is aware of the crowded schedules of trade and industrial arts classes. After-school games, hikes, swimming meets, jumping, chinning, running, and other activities might well become increasingly more important to the vocational school program.

Will the vocational educator have the time and the will to take part in the physical fitness program for the benefit of the young people under their charge, and for victory?

● What about social security? Is it of direct interest to school shop teachers? Perhaps not. But Social Security Board officials have thought much about the relation of social insurance to vocational education pupils. Each year, thousands of young people go directly from the school shop into industry covered by the federal social security law. This means that the young worker is given a social security account card, that he pays social security taxes, and that in time he may benefit from these contributions.

But, has the young worker been made aware of his responsibilities under the law? Is the vocational school teacher equipped to develop such an awareness? Do shop teachers have the facts at hand for this additional task?

I have heard many Social Security Board officials wonder about that. If they have not done much about it themselves, it's because they have been busy with large matters of policy—of planning the battle for freedom from want as President Roosevelt put it in his "State of the Union" message.

But is there reason why the school shop teacher himself, might not write for information to the Social Security Board in Washington, to prepare himself to impart to graduating or leaving pupils facts on the operation of the social security law under which shop pupils will soon be working?

● Now, take post-war planning. It's a gray-looking phrase, which most busy school shop people might wish to skip. But the war will end sometime; and we can all live in a better world, or one racked by the very same evils which have given birth to World War Two.

What can vocational educators do? One man, who has been guiding vocational education for more than a quarter of a century, has been doing a lot of thinking on this subject. He is Dr. J. C. Wright, Assistant U. S. Commissioner for Vocational Education. He has been inspiring other vocational-education minded men and women to think about it.

When Berlin, Tokyo, and Rome are beaten, Dr. Wright sees a great future for vocational education. It is vocational education, he says, which will provide training for the millions of men who will lay down their arms. Pre-employment, refresher, and supplementary courses—short, but intensive—will also help millions of war workers to readjust themselves to nonwar jobs.

For the unemployed, should we have any after the war, Dr. Wright also sees these short, intensive training courses as the best way to meet their needs.

Dr. Wright sees in the post-war world larger units of administration for public vocational schools of less than college grade. He sees regional schools, superbly equipped to train large numbers of pupils from surrounding counties. He sees more industrial training for rural youth. He sees farm youth equipped not only to run a tractor or other machinery, but to repair it; he sees farm girls as well as boys, skillfully handling the many tools and machines which the post-war farm will utilize. He sees vocational school facilities and equipment utilized on double or triple shifts—in order to provide all the training for all who can benefit by it.

These are only a few of the ways in which we will use our vocational education resources to create the kind of world in which we want to live, Dr. Wright believes. And, he says, it is not too early to organize for this new world.

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